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Measuring the effects of visual scan codes in advertising

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Abstract: With smart phone technology becoming increasingly widespread in the consumption space, the use of Visual Scan Codes (VSC) such as QR (Quick Response) or Shazam codes are becoming prominent interactive tools transforming traditional advertising into more engaging and responsive communication platforms. To examine the effects of the presence of these codes, this study uses a (2x2) between-subjects experimental design with treatment groups for code type (QR code active vs. QR code static) and code salience (black and white vs. coloured) with a fifth control group. Findings suggest that such codes have significant effects on hedonic attitudes towards the ad, perceived vividness and brand recall. Participants who noticed the code in the stimulus ad showed higher brand recall and involvement levels. In addition, the mere presence of a static code was found to be perhaps even more effective than an activated code.

Keywords: VSC; visual scan codes; QR codes; Shazam; advertising; vividness; involvement; attitudes.

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1 Introduction

Facilitated by mobile phone technology advancements, Visual Scan Codes (VSC) allow users to use a smartphone to scan a visual cue to interactively gain access to additional information or connect to an external web-based source. QR codes were the first generation of VSC to be used and are short for "Quick Response", meaning that they can be quickly "read" by a smart phone to provide additional useful information related to a product, brand or other objects. Other VSCs include new entrants such as Shazam (Visual Shazaming) who have extended their music recognition technology to also read codes, barcodes and watermarks on fast-moving consumer goods (Riley, 2015; Sparkes, 2015). A QR code represents a two-dimensional matrix-type version of the ubiquitous barcode. The technology originates from Japan; it was developed by Toyota's subdivision and was originally used to track car parts during the manufacturing process (Jackson, 2011). However, the popularity of QR codes came later with the introduction of smart phones enabling the user to scan a code anywhere and from nearly any kind of surface or object. Easy in use, the QR code found its application in many areas: in medicine for issuing prescriptions and patient identification (Lin et al., 2012), in education for engaging students through new multimedia materials (Law, 2012; Ozcelik and Acarturk, 2011), in museums for delivering information about exhibited items (Canadi et al., 2010), in libraries for quick access to information and e-books downloading (Lamb and Johnson, 2013; Lo et al., 2013), even in train tickets in China, on business cards and personalised T-shirts.

With the introduction of smart phones, QR codes have provided an opportunity to turn any traditional advertising into interactive; they have appeared in print, outdoor (Xue and Hairong, 2008) and TV advertising (BusinessWire, 2012; Kim and Yu, 2013), as well as on many packaged goods. Having a sizeable data capacity – up to 4296 alphanumeric characters (Lisa and Piersantelli, 2008), QR codes can trigger consumer actions of differing levels of complexity from simply connecting the user to a company website or downloading a discount voucher to engaging in real-time games. A novel example can be seen from a Sony campaign devoted to the launch of a James Bond movie "Quantum of Solace" (Hamidi, 2008). This campaign required participants to act as spies and collect pieces of information by scanning QR codes appearing on posters.

Now, when any physical object has become potentially clickable (Baker, 2010), QR codes are consumer's portal to a digital world (Baik et al., 2010). Connecting physical and digital worlds by the means of mobile tagging (Canadi et al., 2010; Schmidmayr et al., 2008), QR codes have changed traditional PUSH model of communication to the PULL model where the receiver is able to interact and engage with a brand.

Although there are several studies devoted to the acceptance of QR code technology (Okazaki et al., 2011; Okazaki et al., 2012; Shin et al., 2012; Watson et al., 2013), little is known about the effects of QR codes. The research has shown that 2D bar codes may enhance learning (Ozcelik and Acarturk, 2011). It was found that the attitudes towards advertising with QR codes or QR code loyalty programs are likely to be more positive in low involvement than in high involvement conditions (Narang et al., 2012; Okazaki et al., 2013). However, when consumers are concerned with privacy disclosure or delayed rewards (Okazaki et al., 2013), or experience social anxiety from scanning a QR code in public places, they may become less loyal in comparison with inactive consumers (Okazaki et al., 2012; Okazaki et al., 2012; Okazaki et al., 2013). Although there was found to be no significant main effect of QR code on attitude towards the ad, attitude towards the brand and purchase intention (Veenis, 2012), in specific consumption

situations such as consumption of environmentally friendly and sustainable products (Atkinson, 2013) and at the real estate market (Burke et al., 2013), QR codes were found to add value to the consumer experience.

The present study is aimed to extend our understanding of the effects of VSC codes in advertising. Specifically, the focus of this research is on the estimation and interpretation of the signalling effects of VSC codes, not dissimilar to the signalling effects of web addresses when they were considered a novelty in advertising about 25 years ago, in the early age of the internet (Maddox and Mehta, 1997).

2 Theoretical background

2.1 Visual scan codes and proximity marketing

QR codes are one of the first visual scan codes that offered to link the physical and digital worlds. QR codes were invented in 1994 by Denso Wave, the division of Toyota Motor Corporation. They were designed to quickly scan vehicles during the manufacturing process to check if all the automobile parts were in correct locations (FreeQRCodes, n.d.). Very soon QR codes found their application in a much broader context, including tracing food and pharmaceutical products as well as mobile marketing (QRCode, n.d.). QR codes have been common in consumer advertising as they provide a way to access the brand's website faster than by manually entering a URL address in a browser. In addition, QR codes allowed virtual shops to be created, where consumers could purchase goods by scanning the barcodes directly from ads or full-size images of supermarket shelves (Shop2mobi, 2012).

QR codes have contributed to the growth of proximity marketing, which can be defined as localised wireless distribution of advertising available at a particular place (Petro, 2014). Individuals present at that specific location can receive marketing content via Wi-Fi or Bluetooth or through mobile tagging (Petro, 2014). In addition to QR codes, many other types of visual scan codes were developed, such as: Digimark, Blippar, SnapTag, Google Goggles and Microsoft Tag (Butler, 2014). One of the recent innovations is Shazam. It was originally created as an app that recognises the audio from music and identifies what song is currently playing (O'Brien, 2016). This technology has been also used in TV commercials and in-store promotions to engage consumers by sending exclusive brand content (O'Brien, 2016). Likewise, augmented reality is becoming an increasingly popular proximity marketing tool. For instance, it allows a promotional poster to be transformed into a video when viewing with a mobile or tablet camera (Brown, 2014).

Around 2012–2014, QR codes received serious criticism in the press. Adoption of this technology among the general population appeared to be slow for multiple reasons. Firstly, the experience of tagging a QR code was not standardised, and mobile phones had no pre-installed QR code readers (Savitz, 2012). Meanwhile, scanning QR codes required some time and effort, and may have been confusing even for tech-savvy customers (Brown, 2014). It was noted that consumers were moving away from barcodes because mobile barcode-linked content was poorly aligned with consumer expectations (eMarketer, 2012). Often advertisers have used QR codes as a simple link to a company website (Wilkerson, 2012). However, in most cases, consumers expect to receive a discount or a gift after following a barcode (O'Neill, n.d). The experience might be even more disappointing if a QR code is linked to a website not optimised for smartphones (Strout, 2013).

Sceptics have been recently concerned with the security risks related to QR codes. Hackers can use a QR code for various malicious purposes, such as phishing, which involves creating fake posters with QR codes and redirecting consumers to fake "phishing" websites, where their passwords are compromised (Infosec, 2015). Through the use of illegitimate QR codes, scammers are able to access a consumer's phone camera, microphone, GPS, obtain sensitive data (password, files, contacts and transactions), read personal emails and text messages, and send out premium texts at high fees (Infosec, 2015).

After a period of stagnation, a new wave of interest towards QR codes was instigated by introduction of wearable devices, such as smart watches and smart glasses (Schneider, 2016). QR codes are seen as more effective in increasing interactivity between real world and digital life for "wearers", since wearable devices make the process of VSC scanning more effortless (Schneider, 2016). The future of QR codes might be associated with the new technologies, such as: 3D holograms embedded in QR codes (Mack, 2014) and a new generation of messengers (Griffith, 2016).

2.2 QR codes and web address signal effects

Since QR codes and web addresses have a similar interactive nature and functionality, their effects may be possibly similar. In the early days of the emerging internet, adding a web address to an advertisement was perceived as a novelty. Back then the Journal of Advertising Research published a study by Maddox and Mehta (1997) who discovered that 91% of respondents perceived advertisers with URLs as being more high-tech and 71% viewed them as being more sophisticated (Maddox and Mehta, 1997). The authors argued that companies could improve their image by simply including a web-address in their advertisements (Maddox and Mehta, 1997). Even if consumers do not use the mentioned URLs, they would perceive ads containing web addresses as more "customer-oriented", "high-tech", and "sophisticated" (Maddox and Mehta, 1997, p.54) suggesting some kind of signalling effect.

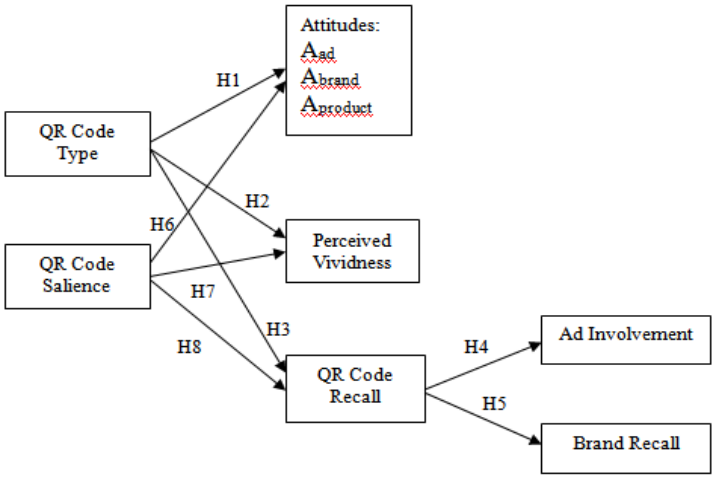
2.3 Dual-process model of interactivity effects

A Dual-process model of interactivity effects developed by Liu and Shrum (2009) explains why exposure to interactive features may work as well as actually using them, and in some cases even be more powerful (Liu and Shrum, 2009). According to their model, under different circumstances interactivity may either enhance or inhibit persuasion. More specifically, in low involvement conditions the mere presence of interactivity serves as a peripheral cue and is likely to produce favourable attitudes. Under high involvement, however, actual engaging in interactivity may have one of two outcomes – positive or negative. In the first case, depending on personal and situational factors, interactivity may play a facilitating role by enhancing information processing, consequently leading to more positive attitudes. In the second case, interactivity may play an inhibiting role by occupying a person's processing resources, creating difficulties on the way to task completion and consequently, resulting in rather negative attitudes (Liu and Shrum, 2009). The certain expectations of what the interactive capability can deliver could also possibly lead to negative attitudes if that feature under-delivers on that promise (Liu and Shrum, 2009).

3 Conceptual model and hypotheses

Drawing from the literature, this study proposes a model of effects of a VSC code in advertising (see Figure 1). To verify our general model, we choose the most common form of current VSC, the QR code to validate our proposed framework. Following exposure to an advertisement with or without a QR code, a consumer is expected to experience differences in attitudes (H1), perceived vividness (H2) and QR code recall (H3). QR code recall in turn is predicted to increase advertising involvement (H4) and brand recall level (H5). The development of the hypotheses is presented below.

Figure 1 Conceptual model: potential effects of a VSC code in advertising



A QR code is a tool that transforms traditional advertising into more engaging and interactive communication platforms by enabling three key features of interactivity: two-way communication, user's control and synchronicity (Johnson et al., 2006; Liu and Shrum, 2002; McMillan and Hwang, 2002; Rafaeli, 1988; Rice and Williams, 1984; Williams et al., 1988; Wu et al., 2010). Because interactivity produces more positive attitudes than non-interactive environments (Cho, 2004; Chung and Zhao, 2004; Fortin and Dholakia, 2005; Teo et al., 2003), it is hypothesised that:

H1: An active QR code connected to a website will produce more favourable Attitude towards the ad (A_{ad}) than a static not connected QR code

By connecting traditional offline media with online resources, a QR code is capable of enhancing the richness of the consumer experience. Thus, traditional advertising gains a feature which previously was related only to online interactive advertising – vividness. Vividness is referred to "the representational richness of a mediated environment as defined by its formal features; that is, the way in which an environment presents information to the senses" (Steuer, 1992, p.81). Vividness relates to the breadth and depth of the message. Here, breadth means the number of sensory dimensions such as colours, graphics, sounds, and depth refers to the quality of the presentation (Steuer, 1992). Because QR codes increase the number of sensory dimensions of the message communicated to the consumer, it can be suggested that a QR code may increase perceived advertising vividness:

H2: An active QR code connected to a website will produce higher perceived ad vividness than a not connected static QR code

It has been established by research in social psychology that learning for novel stimuli occurs faster than for familiar stimuli (Lubow and Moore, 1959). Because of the novelty factor, it is expected that consumers will notice and remember a QR code in the stimulus ad. Therefore:

H3: An active QR code will be positively related to QR code recall

Because interactivity was found to have a positive effect on advertising involvement (Fortin and Dholakia, 2005; Zhenhui et al., 2010), it follows that people who noticed the presence of a QR code in an ad, are likely to be more involved:

H4: QR code recall will be positively related to advertising involvement

The previous research has found that interactivity has positive effect on consumer's memory (Ariely, 2000; Chung and Zhao, 2004). As explained by these scholars, the effect of increased memory is facilitated by the user's control over the information flow occurring in the interactive environment (Chung and Zhao, 2004) and is especially profound when processing resources are sufficiently high (Ariely, 2000). Therefore, it may be hypothesised that:

H5: QR code recall will be positively related to brand recall

Because of the widespread belief that coloured or unusually looking QR codes perform better that traditional black-and-white QR codes and because of continuous experimentations with QR codes' designs at the market (Chu et al., 2013; Lin et al., 2013), the proposed theoretical framework also incorporates QR Code Salience and proposes to test its effects on major advertising response variables (H6 – H8). Following the argumentation of visual salience theories, it is suggested that a more salient QR code is more likely to attract consumer's attention (Guido, 2001; Michael and Gálvez-García, 2011; Schubö, 2009; Wolfe, 2001). Also, because colour in advertising was found to increase arousal and enhance recall (Warner and Franzen, 1947), it is hypothesised that:

H6: Coloured QR codes will produce more favourable Attitude towards the ad (A_{ad}) than black and white QR codes

H7: Coloured QR codes will result in higher perceived ad vividness than black and white QR codes

H8: Coloured QR codes will create higher QR code recall than black and white QR codes

The suggested hypotheses will be tested using experimental approach which is discussed in the following sections.

4 Methodology

In order to test the proposed hypotheses, this study uses a (2x2) between subjects experimental design with treatment groups for VSC code type (QR code active vs. static) and code salience (black and white vs. coloured) with a fifth control group generating five experimental conditions in an incomplete between subjects factorial design. The

experimental approach was selected as it is the best recommended procedure to study consumer response in online environments (Fortin and Ballantine, 2009). The control group will serve as a baseline measure to compare the effects of the stimulus ad without the presence of a QR code.

4.1 Procedure

Participants were invited to an online experiment where they were randomly assigned to one of five treatment groups. Survey instructions stated that participants would be asked for their opinions about a new print magazine. They would need to first flip through several pages of a flash-based magazine and then answer a set of corresponding questions. Being randomly assigned to one of four experimental conditions or to the control group, participants were exposed to the same Coca-Cola Zero print ad inserted in the mock magazine with different QR-code variations as per the treatment groups: active or static QR code, black and white or coloured QR code. Respondents from the control group were exposed to the same ad but without a QR code. To avoid the possibility that participants may not have access to a smart phone or QR code reading application, the procedure allowed respondents to mouse click on the QR code instead of scanning it with a smart phone (see Figure 2). To facilitate this, the connected QR codes were accompanied by the visual note 'Click on the QR code to learn more'. The connected QR codes were linked to a specifically created web-page which contained entertaining information about Coca-Cola Zero. This information consisted of a newly released Hollywood movie called Battleship and a Coca-Cola video ad utilising this Battleship theme. Meanwhile, the not connected QR code was not linked to any web-page. The given QR codes were shown as black and white or in colour with a Coca-Cola logo inside it.

Figure 2 Stimulus material

4.2 Measurements

The study used existing scales used in similar studies in the literature such as Attitude towards the ad (A_{ad}) (Batra and Ahtola, 1991; Voss et al., 2003), Attitude towards the brand (A_{brand}) (MacKenzie et al., 1986), Perceived vividness (Steuer, 1992), Attitude towards the product (Underwood and Klein, 2002), and Advertising involvement (Lee, 2000). All Cronbach alpha values ranged from .805 to .925, revealing internal consistency and reliability of the scales.

5 Results

A total of 210 respondents fully completed the online experiment and were recruited online through social media groups. Participants were offered a chance to win a movie voucher as an incentive to join the study. The obtained sample consisted of 127 females (60.5%) and 83 males (39.5%). Respondents' ages ranged from 18 to 65, with a total of 61% of the sample being in 18–24 age group. Meanwhile, respondents between 25 and 34 years old (20.5%) represented the second largest group in the sample, following by 34–45 years olds (10%). Regarding annual household income, nearly half of the respondents (47.6%) described themselves as being in the middle third of the population.

The click through statistics provided by Google Analytics indicated that a total of 14 respondents (16%) attempted to actually mouse click at the QR code during the experiment. The relatively small click through rate may be explained by the overall lack of understanding of QR codes among the population observed by other researchers (Sago, 2011) which is determined by perceived information value of QR code advertising, its entertainment value and perceived ease of use (Jong-Hyuok et al., 2012).

Hypotheses H1–H3 and H6–H8 were tested using MANCOVA. QR Type and QR Code Salience were entered as independent variables. Meanwhile, attitude towards the ad, perceived vividness and QR code recall were entered as dependent variables. The data were examined for normal distribution using the skewness and kurtosis procedure, and for homogeneity using a Box's M test. To address an incomplete factorial design which, in fact, includes a 2x2 specified design with an extra cell representing a control group, Type IV sum of squares was selected instead of the default Type III method. The A_{ad} scale was deconstructed into the cognitive and hedonic components as per Spangenberg et al. (1997) and included in the analysis.

The MANCOVA revealed a significant main multivariate effect for type of QR code, Wilks' $\lambda = .919$, $F(3, 202) = 5.974$, $p < .001$, $\eta_p^2 = .081$. At the univariate level (see Table 1), the QR code type showed a significant effect on hedonic attitude towards the ad, $F(1, 204) = 9.411$, $p < .005$, $\eta_p^2 = .044$; perceived vividness, $F(1, 204) = 9.293$, $p < .005$, $\eta_p^2 = .044$, and QR code recall, $F(1, 204) = 5.155$, $p < .05$, $\eta_p^2 = .025$. The pattern of the QR code's effects appeared to be similar for all three significant dependent variables with the static QR code generating the most positive effect (see Figure 3). A further LSD Post Hoc test suggests that the static QR code outperforms the active code connected to a website. Specifically, the static QR code has a greater positive impact on hedonic attitude towards the ad ($M_{\text{mean difference}} = .6696$, $p < .001$), vividness ($M = .3968$, $p < .005$) and QR code recall ($M = .14$, $p < .05$) than the active bar code. However, results do not show statistically significant effects for QR code salience.

Table 1 MANCOVA analysis: tests of between-subjects effects

Source	*Dependent Variable*	*Type IV Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*	*Partial Eta Squared*
Corrected Model	Hedonic_at_ad	27.534[a]	5	5.507	3.178	.009	.072
	Vividness	7.346[b]	5	1.469	2.210	.055	.051
	QR_code_recall	15.608[c]	5	3.122	18.201	.000	.308
Intercept	Hedonic_at_ad	1111.693	1	1111.693	641.607	.000	.759
	Vividness	731.714	1	731.714	1100.462	.000	.844
	QR_code_recall	17.330	1	17.330	101.047	.000	.331
Education	Hedonic_at_ad	7.848	1	7.848	4.529	**.035**	.022
	Vividness	.535	1	.535	.804	.371	.004
	QR_code_recall	.036	1	.036	.212	.646	.001
QR_code	Hedonic_at_ad	16.306	1	16.306	9.411	**.002**	.044
	Vividness	6.179	1	6.179	9.293	**.003**	.044
	QR_code_recall	.884	1	.884	5.155	**.024**	.025
Colour	Hedonic_at_ad	.018	1	.018	.011	.918	.000
	Vividness	.003	1	.003	.004	.950	.000
	QR_code_recall	.095	1	.095	.555	.457	.003
QR_code* Colour	Hedonic_at_ad	.480	1	.480	.277	.599	.001
	Vividness	.026	1	.026	.039	.844	.000
	QR_code_recall	.224	1	.224	1.309	.254	.006
Error	Hedonic_at_ad	353.465	204	1.733			
	Vividness	135.643	204	.665			
	QR_code_recall	34.987	204	.172			
Total	Hedonic_at_ad	4178.375	210				
	Vividness	2915.222	210				
	QR_code_recall	125.000	210				
Corrected Total	Hedonic_at_ad	380.999	209				
	Vividness	142.989	209				
	QR_code_recall	50.595	209				

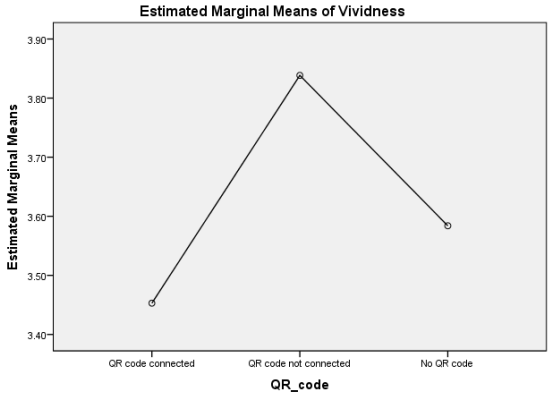
Notes: * R Squared = .072 (Adjusted R Squared = .050).
R Squared = .051 (Adjusted R Squared = .028).
R Squared = .308 (Adjusted R Squared = .292).

Hypotheses H4 and H5 were tested using the independent sample t-tests. QR code recall was entered as independent variable. Meanwhile, advertising involvement and brand recall were entered one by one as dependent variables.

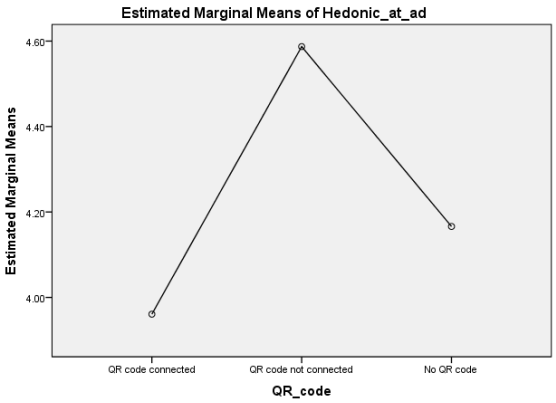
H4 states that QR code recall is positively related to advertising involvement. Results demonstrate that consumers who remembered noticing the QR code are significantly more involved in the advertisement than those who did not notice the code: $t = -3.142$, $df = 208$, $p < .005$, $M_{noticed} = 3.3827$, $M_{did\ not\ notice} = 2.7961$.

H5 states that QR code recall is positively related to brand recall. Results indicate that participants who remembered noticing the QR code demonstrate a significantly higher brand recall as opposed to those who did not notice the barcode: $t = -2.211$, $df = 159.966$, $p < .05$, $M_{noticed} = 2.12$, $M_{did\ not\ notice} = 1.82$.

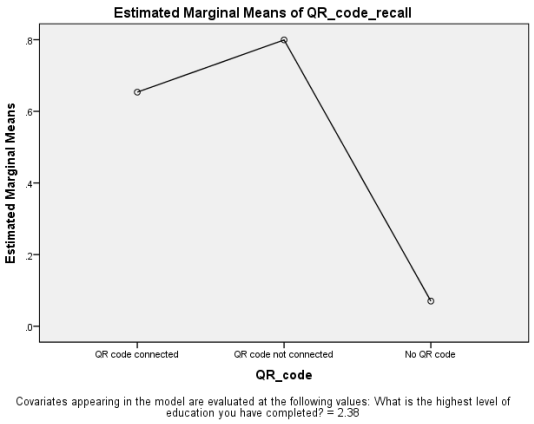
Figure 3 Profile plots: effects of QR code type



(a) Perceived Vividness



(b) Hedonic A_{ad}



(c) QR Code Recall

Education was found to be a significant covariate at the univariate level for hedonic attitude towards the ad, $F(1, 204) = 4.529$, $p < .05$, $\eta_p^2 = .022$. In particular, hedonic attitude towards the stimulus ad with a QR code was found to be more favourable for individuals with either lowest ($M_{high\ school} = 4.479$, $M_{college} = 4.483$) or highest levels of education ($M_{PhD} = 4.444$) rather than for most university graduates ($M_{bachelor\ degree} = 3.935$, $M_{postgraduate\ diploma} = 4.092$, $M_{masters\ degree} = 4.029$).

6 Discussion

This study contributes to advertising theory by extending our understanding of the effects of VSC codes in five significant ways. Firstly, while most of the previous literature on QR codes is focused on technology acceptance and users' motivations, few studies have examined their influence on advertising effectiveness, which is the focal point of this study. The present research was designed to investigate the effects of QR code Type and Salience on a wide range of consumer responses. Secondly, the present study proposes a conceptual model of QR code's effects in advertising which includes a range of direct and indirect effects. The experiment showed that a QR code impacts positively on hedonic attitude towards the ad, perceived vividness and QR code recall. Thirdly, the results highlight a difference between those respondents who can remember noticing the QR code in the advertisement and those who didn't. It appeared that the participants who noticed the code were significantly more involved in the ad and then showed higher brand recall afterwards. Fourthly, findings suggest that a static QR code can be as or even more effective than an active QR code. This is counter-intuitive but does support previous research by Liu and Schrum (2009). It implies that when consumers notice a QR code available in the ad, but do not scan it, they can form more positive attitudes towards this ad. This is consistent with web address research from the 90's (Maddox and Mehta, 1997); that is, signalling of what the code provides is perhaps more powerful that what it actually delivers as a benefit. Finally, the data shows no significant difference for vividness effects of a coloured QR code and a standard black and white QR code. Thus, it seems that QR code salience in terms of creative tactics may not affect advertising effectiveness in a significant way.

Overall, the findings bring into question the expectation that the effects of a visual stimulus such as a VSC will always be positive. Rather, the findings support the Dual-process model of interactivity effects (Liu and Shrum, 2009). In this study, a low involvement condition was considered when a consumer had a QR code available, but did not use it. Findings indicate that under low involvement conditions, responses to the ad with a QR code are likely to be positive. In this study, a high involvement condition was considered when a person actually scanned a QR code. Results show that under high involvement, the barcode may play an inhibiting role and therefore, can do more harm than good.

Perhaps an explanation for this phenomenon is the participant's disappointment resulting from the information consumers received after reading the code. This is supported by numerous observations reported in the media (Brown, 2014; eMarketer, 2012; O'Neill, n.d.; Strout, 2013; Wilkerson, 2012). As defined by Bell (1985) disappointment is a "psychological reaction to an outcome that does not meet a decision maker's priori expectation" (as cited in van Dijk et al., 2003, p.506). It is related to "the sense of loss or gain incurred by resolution of a chosen alternative" (Bell, 1985, p.117). The advertisement used in the present experiment resembles the majority of QR code ads

in the market which provide non incentive-based content (Okazaki et al., 2011). Previous research, however, shows that most consumers expect to get an incentive after reading a QR code such as a discount or a product sample (Okazaki et al., 2011). Thus, it may be inferred that consumers are generally disappointed by QR codes and what they deliver in added value.

This is consistent with studies demonstrating that information quality is the main driver for using QR codes (Jong-Hyuok et al., 2012; Shin et al., 2012). Shin (2012) states that for QR codes, it is not enough to be responsive. He defines information quality as "the quality users experience during an interaction; that is, how the users obtain the information they want and what kind of quality information/services they receive" (Shin et al., 2012, p.1424). He argues that consumers will not accept QR code technology, unless after scanning they gain some form of quality information (Shin et al., 2012).

In fact, consumers can anticipate their disappointment of the information allocated behind the QR codes. According to Theory of Disappointment, potential disappointment has a greater impact on preference than potential satisfaction which implies risk aversion for the decision maker (Bell, 1985). Therefore, consumers may try to avoid risk of scanning the code to prevent their unpleasant psychological reaction. This explains the relatively low click-through rate (16%) of the QR code in the present experiment and also provides an additional explanation of why the mere presence of an inactive QR code appeared to be even more effective than an activated QR code.

7 Managerial implications

Apart from the theoretical insights provided by the present research, this study offers useful implications for practitioners who wish to incorporate VSC codes into their advertising campaigns. Based on the findings, firms may use VSC codes in traditional advertising to increase perceived vividness, hedonic attitude towards the ad, ad involvement and brand recall. Secondly, use of either black-and-white or coloured versions of a QR code does not appear to influence advertising effectiveness. Thirdly, marketers should focus on designing useful and relevant information which will be encoded in the QR code to meet consumer's expectations. It may be worthwhile to provide a hint of what valuable information is to be found behind the code. Fourthly, advertisers should not expect that large numbers of consumers will actually scan the QR code, but rather use QR codes as a signal to enhance brand imagery. In order to attract attention to the QR code, it needs to be visible and recognisable as a component of the ad. Even if individuals do not scan the code, they are more likely to be involved with the ad and better remember the brand after exposure.

8 Limitations and future research

Future research should attempt to replicate these seminal results with other product categories and with a wider range of advanced digitally-based benefits as technology improves over time. Also, further research should examine the effect of incorporating other types of VSCs such as the new Shazam codes (Riley, 2015) in different forms of advertising and on packaging designs. The present study has employed the stimulus ad where a QR code represented an independent element not related to the ad concept. However, a VSC code incorporated in the advertisement's creative concept might be the

focus of further theoretical development. In this study, participants had a choice to click or not to click on a visible QR code. Future experiments could use a different procedure to avoid possible self-selection biases.

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